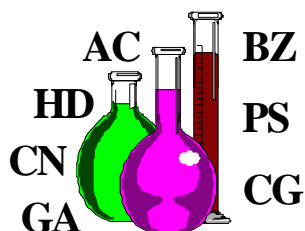


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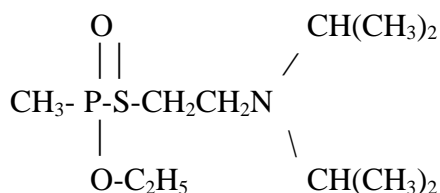


Detailed Facts About Nerve Agent VX

218-05-1096

Physical Properties of Nerve Agent VX

Chemical Structure



Chemical Formula

$\text{C}_{11}\text{H}_{26}\text{NO}_2\text{P S}$

Description

Nerve agent VX is an oily liquid that is clear, odorless, and tasteless. It is amber colored similar in appearance to motor oil.

Molecular Weight

267.4

Vapor Pressure (mm Hg)

0.0007 @ 25°C

Boiling Point

298°C

Freezing Point

-51°C

Density

Liquid = 1.01
Vapor = 9.2 (air = 1)

Solubility

Moderate in H_2O

Flash Point

159°C

Volatility

10.5 mg/m^3 @ 25°C

<i>Toxicity Values</i>	IC ₅₀ (inhalation)	= 25 mg-min/m ³ (15 l/min)
	LC ₅₀ (inhalation)	= 30 mg-min/m ³ (15 l/min)
	LD ₅₀ (skin)	= 0.142 mg/kg
	1% Lethality	= 4.3 mg-min/m ³
	No Deaths Level	= 2.5 mg-min/m ³
	NOAEL	= 1.6 mg-min/m ³ (estimated)

Exposure Limits

Workplace Time-Weighted Average -	0.00001 mg/m ³
General Population Limits -	0.000003 mg/m ³

Toxic Properties of Nerve Agent VX

Nerve Agent VX is stored in the unitary stockpile in ton containers, artillery shells, mortar projectiles, rockets, and land mines. Stockpiled in Anniston Army Depot, AL; Blue Grass Army Depot, KY; Newport Army Ammunition Plant, IN; Pine Bluff Arsenal, AR; Tooele Army Depot, UT; and Umatilla Depot Activity, OR.

Nerve Agent VX is a persistent, nonvolatile agent that is primarily a liquid exposure hazard to the skin or eyes, although small amounts of VX vapor may be generated under extremely high temperatures. Nerve Agent VX affects the body by blocking the action of the enzyme acetylcholinesterase. When this enzyme is blocked, large amounts of the chemical acetylcholine build up at critical places within the nervous system, causing hyperactivity of the body organs stimulated by these nerves. The signs and symptoms of exposure to Nerve Agent VX depend upon the *route of exposure* and the *amount of exposure*.

Overexposure Effects

Signs and symptoms of overexposure may occur within minutes or hours depending upon dose. They include: miosis (constriction of pupils) and visual effects, headache and pressure sensation, runny nose and nasal congestion, salivation, tightness in the chest, nausea, vomiting, giddiness, anxiety, difficulty in thinking, difficulty sleeping, nightmares, muscle twitches, tremors, weakness, abdominal cramps, diarrhea, involuntary urination and defecation. Signs of severe exposure can progress to convulsions and respiratory failure.

Emergency and First Aid Procedures

Inhalation: hold breath and don respiratory protection mask; administer immediately, in rapid succession, all three Nerve Agent Antidote Kits, Mark I injectors if severe signs of agent exposure appear; use mouth-to-mouth resuscitation when approved mask-bag or oxygen delivery systems are not available, but do not use mouth-to-mouth resuscitation when facial contamination exists; if breathing is difficult, administer oxygen; seek medical attention immediately.

Eye Contact: flush eyes immediately with water for 10-15 minutes, then don a respiratory

protective mask. Although miosis may be an early sign of agent exposure, do not administer an injection when miosis is the only sign present; seek medical attention immediately.

Skin Contact: don respiratory mask and remove contaminated clothing; wash contaminated skin with copious amounts of soap and water immediately using 10 percent sodium carbonate solution, or 5 percent liquid household bleach; rinse well with water to remove decontamination; if local sweating and muscular symptoms occur, administer an intramuscular injection with the MARK I Kit; seek medical attention immediately.

Ingestion: do not induce vomiting; first symptoms are likely to be gastrointestinal; administer immediately 2 milligrams intramuscular injection of the MARK I Kit auto injectors; seek medical attention immediately.

Protective Equipment

Protective Gloves: Wear Butyl Glove M3 and M4 Norton, Chemical Protective Glove Set.

Eye Protection: Wear chemical goggles; use goggles and faceshield for splash hazards.

Other: Wear gloves and lab coat with M9 or M17 mask readily available for general lab work.

Reactivity Data

Stability: Persistent; relatively stable at room temperature; unstabilized VX of 95 percent purity decomposed at a rate of 5 percent a month at 71°C.

Hazardous Decomposition Product: During basic hydrolysis of VX up to about 10 percent of the agent is converted to EA2191 (diisopropylaminoethyl methylphosphonothioic acid). Based on the concentration of EA2192 expected to be formed during hydrolysis and its toxicity (1.4 mg/kg dermal in rabbit at 24 hours in a 10/90 wt% ethanol/water solution), a Class B poison would result.

A large scale decon procedure, which uses both HTH and NaOH, destroys VX by oxidation and hydrolysis. Typically, the large scale product contains 0.2 - 0.4 wt percent EA2192 at 24 hours. At pH 12, the EA2192 in the large scale product has a half-life of about 14 days. Thus, a 90 day holding period at pH 12 results in about a 64-fold reduction of EA2192 (six half-lives). This holding period has been shown to be sufficient to reduce the toxicity of the product below that of a Class B poison.

Other less toxic products are ethyl methylphosphonic acid, methylphosphonic acid,

diisopropylaminoethyl mercaptan, diethyl methylphosphonate, and ethanol.

A small scale decontamination procedure uses sufficient HTH to oxidize all VX; thus no EA2192 is formed.

Hazardous Polymerization: Will not occur.

Persistency Depends upon munitions used and the weather. Heavily splashed liquid persists for long periods of time under average weather conditions.

References

1. Department of the Army (DA PAM) 40-8, *Occupational Health Guidelines for the Evaluation and Control of Occupational Exposure to Nerve Agents, GA, GB, GD, and VX*, December 1990.
2. Department of the Army Field Manual (DA FM) 3-9, *Potential Military Chemical/Biological Agents and Compounds*, 1990.
3. U.S. Army Chemical Command Materiel Destruction Agency, *Site Monitoring Concept Study*, 15 September 1993.

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